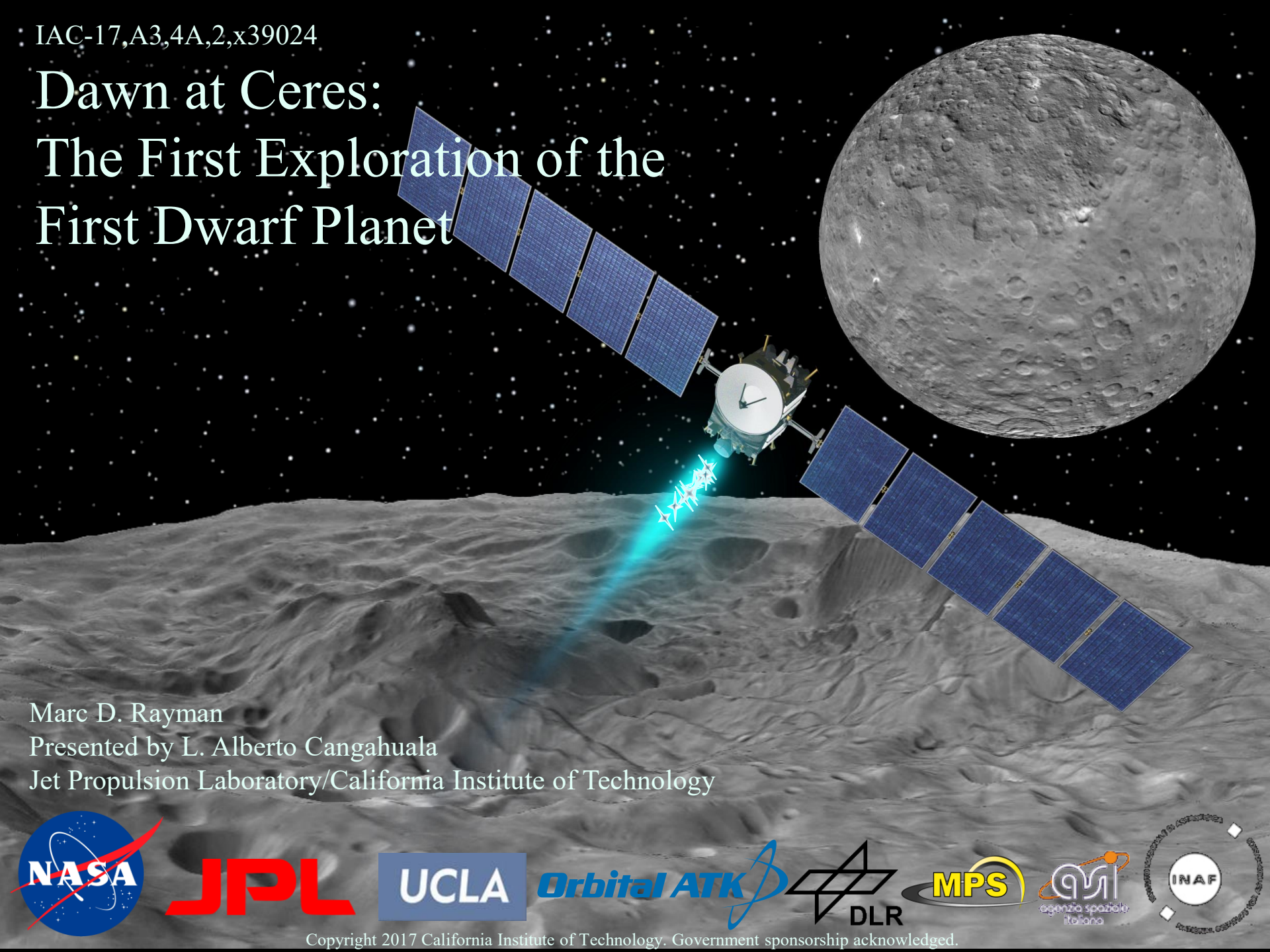
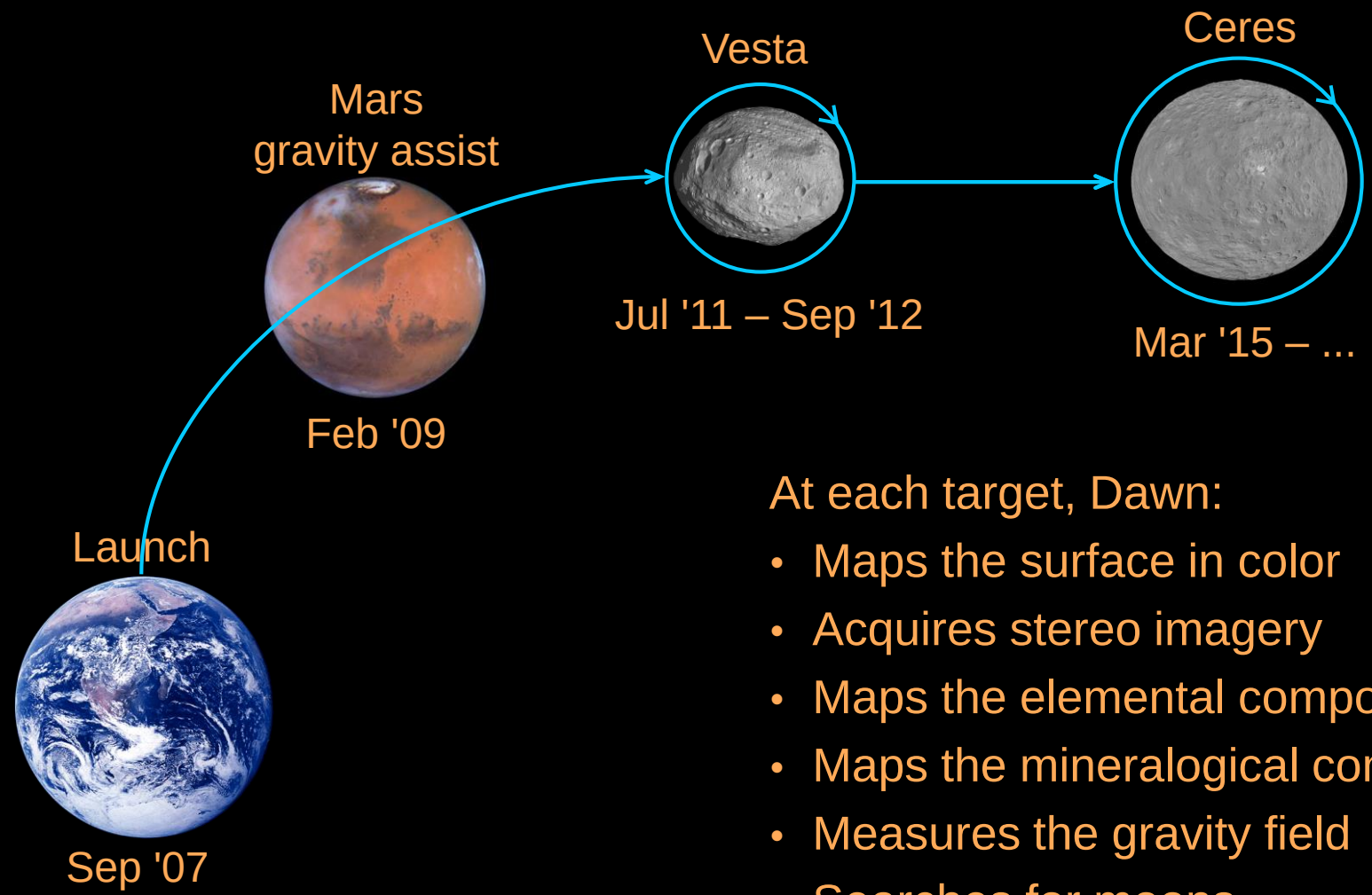
IAC-17,A3,4A,2,x39024

Dawn at Ceres: The First Exploration of the First Dwarf Planet



Marc D. Rayman
Presented by L. Alberto Cangahuala
Jet Propulsion Laboratory/California Institute of Technology

Mission Itinerary

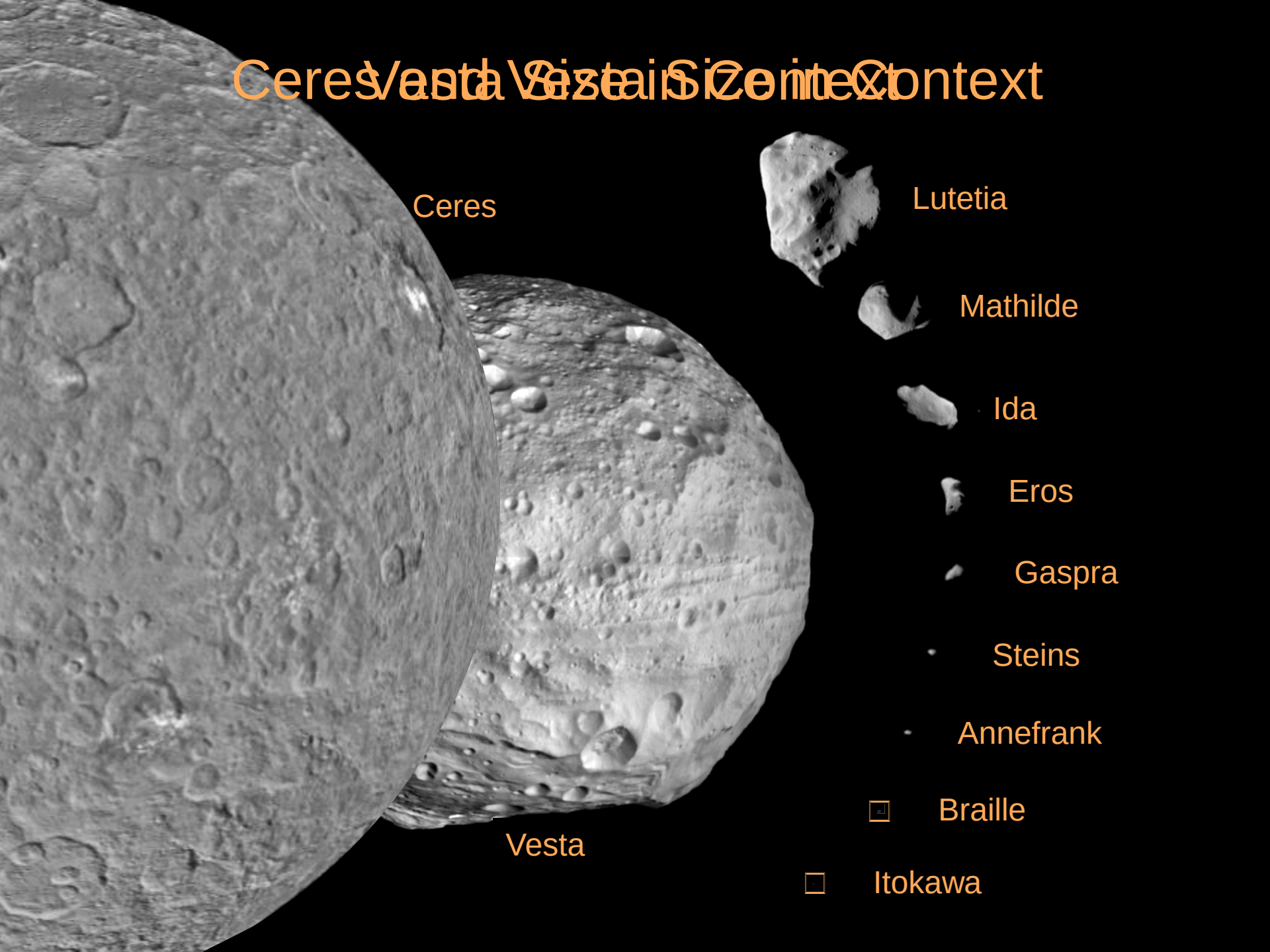


Note: Text not to scale.

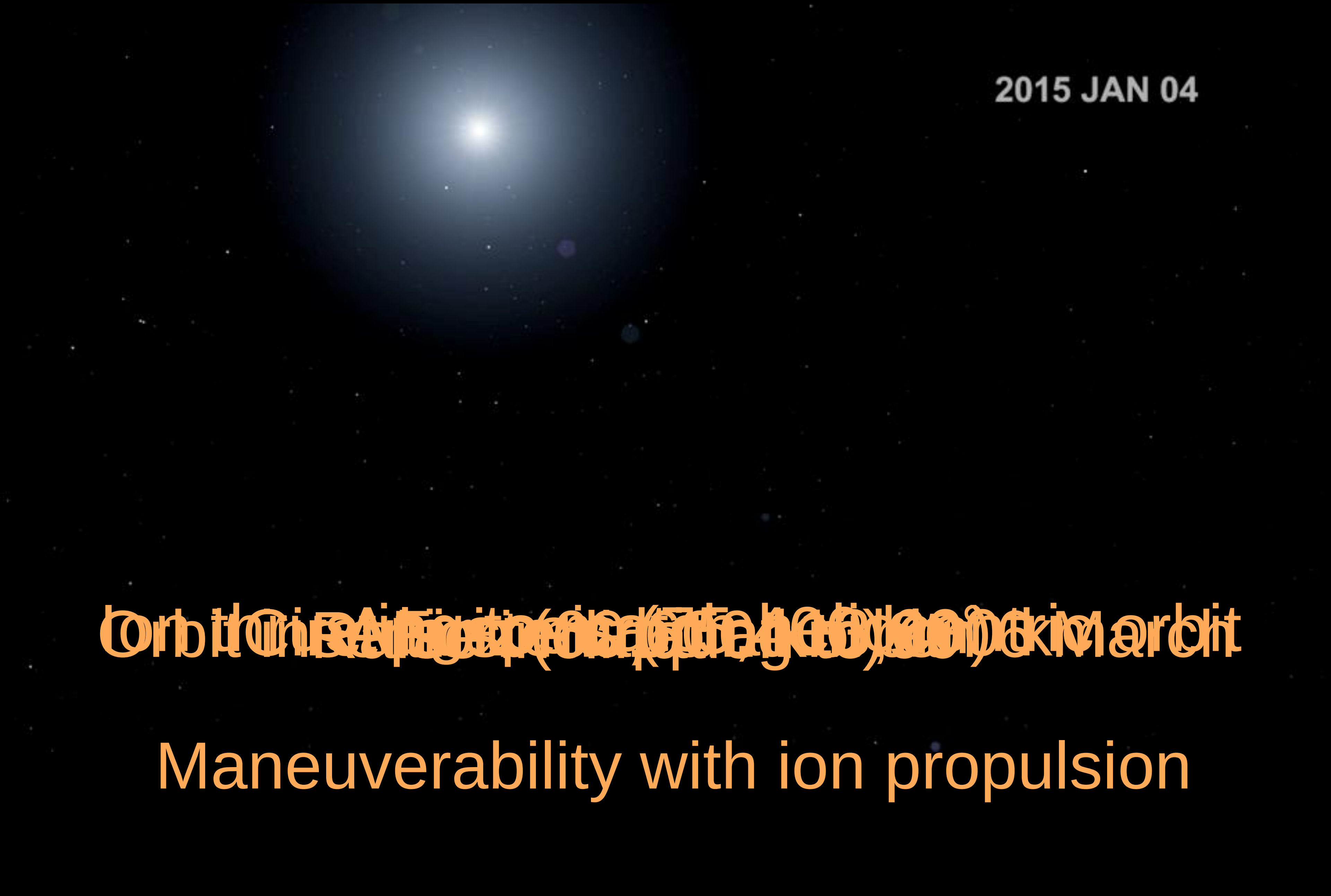
At each target, Dawn:

- Maps the surface in color
- Acquires stereo imagery
- Maps the elemental composition
- Maps the mineralogical composition
- Measures the gravity field
- Searches for moons

Ceres and Vesta in Size Context



Dawn at Ceres



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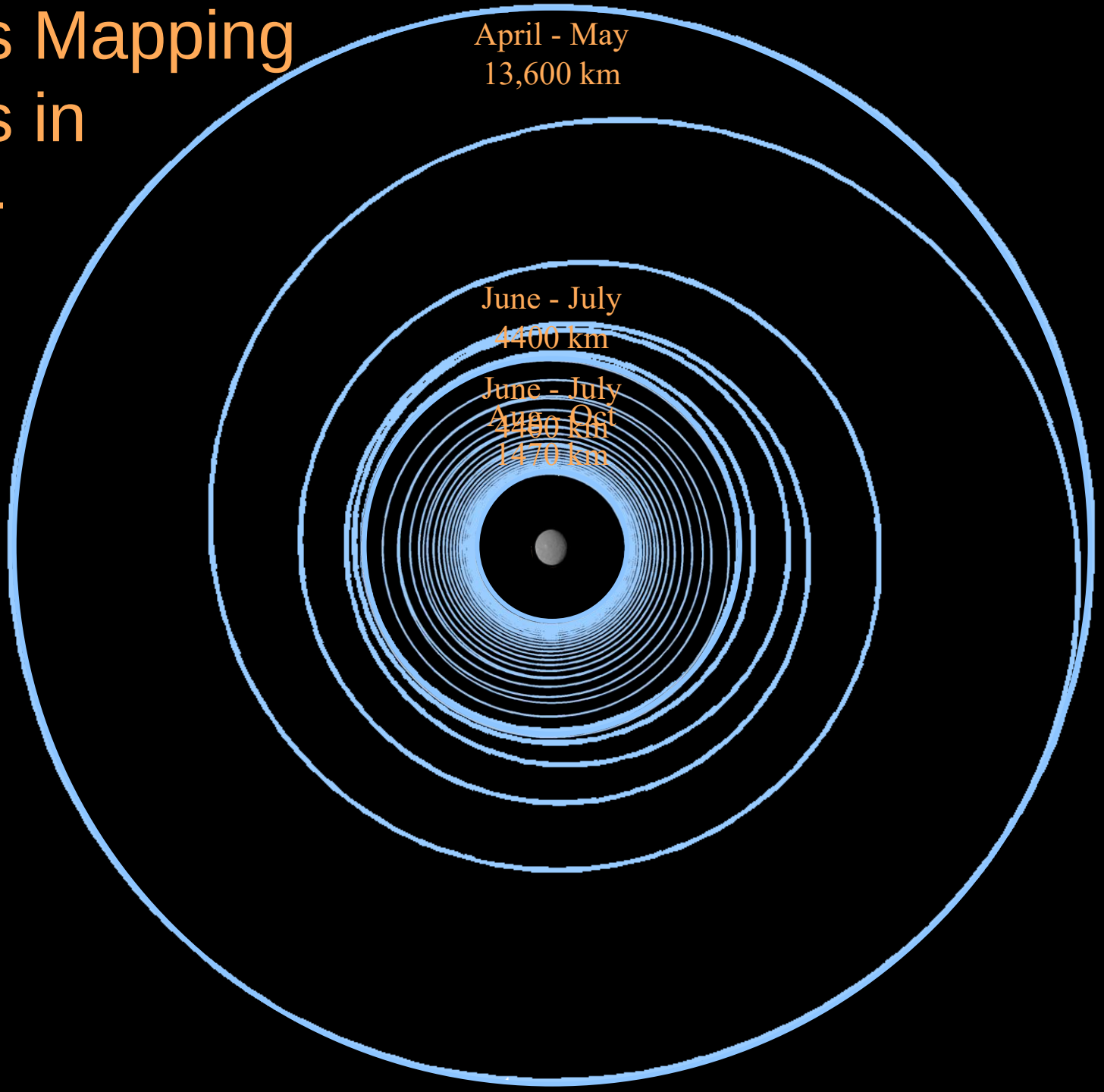
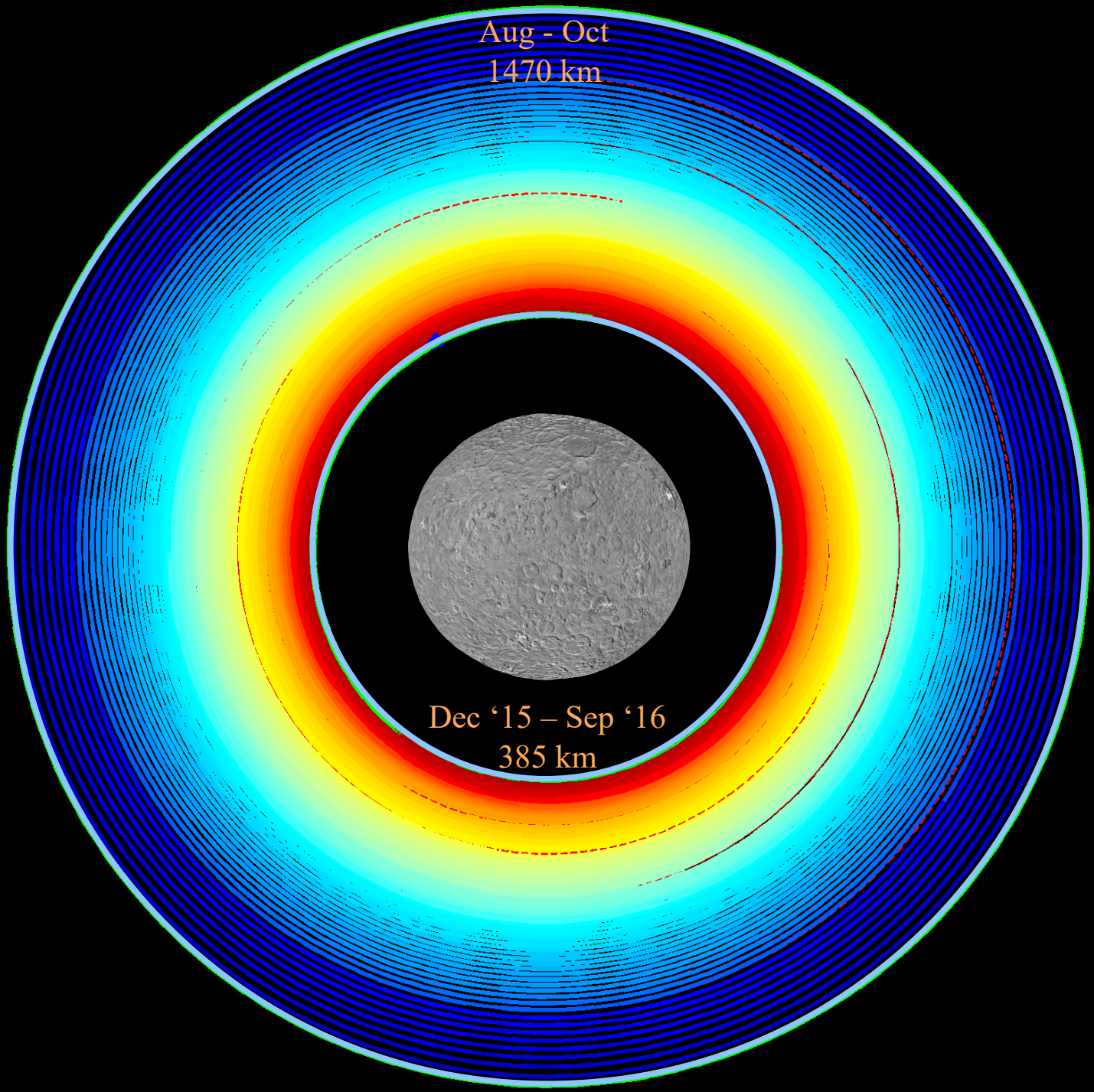
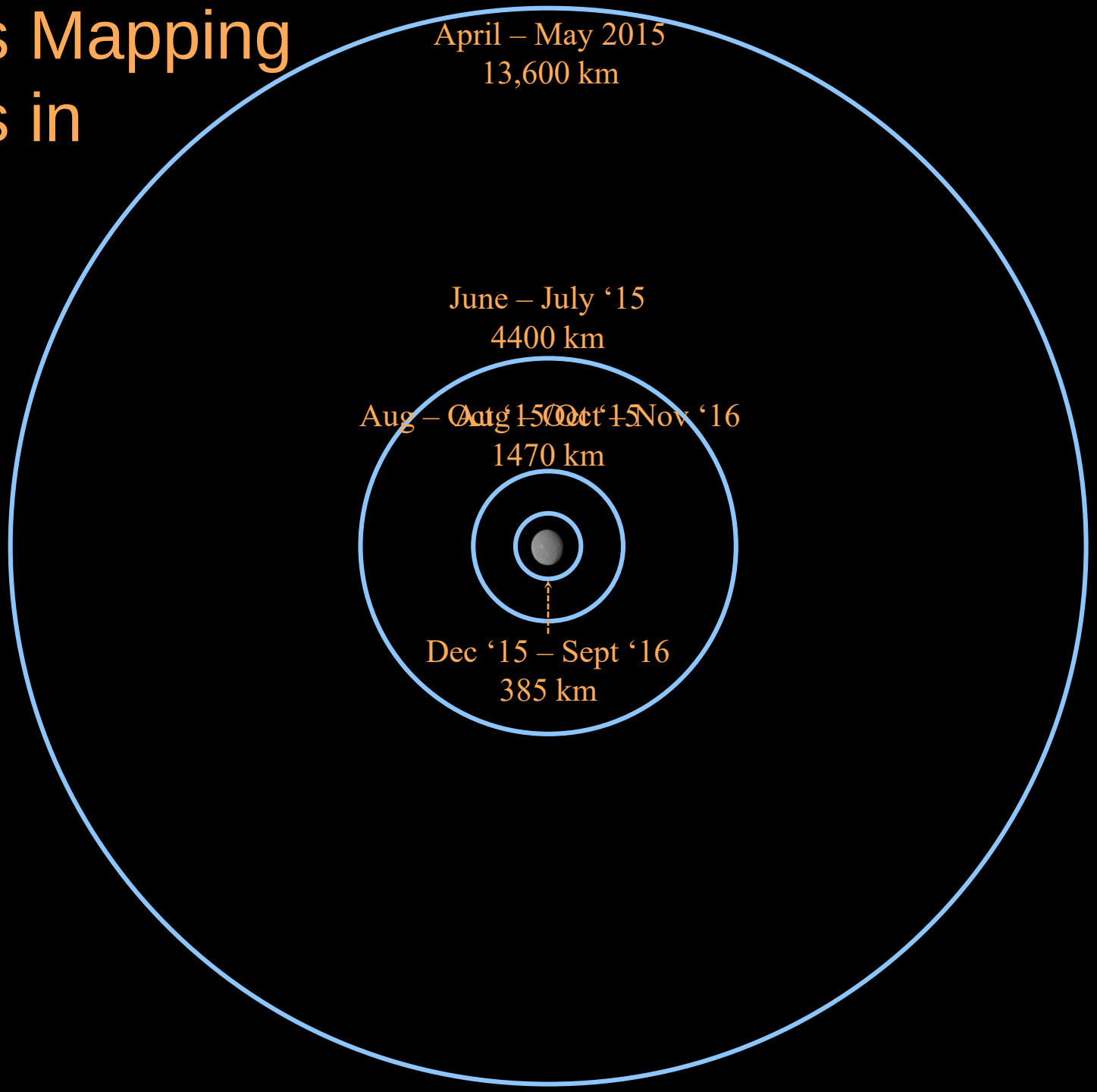
Maneuverability with ion propulsion

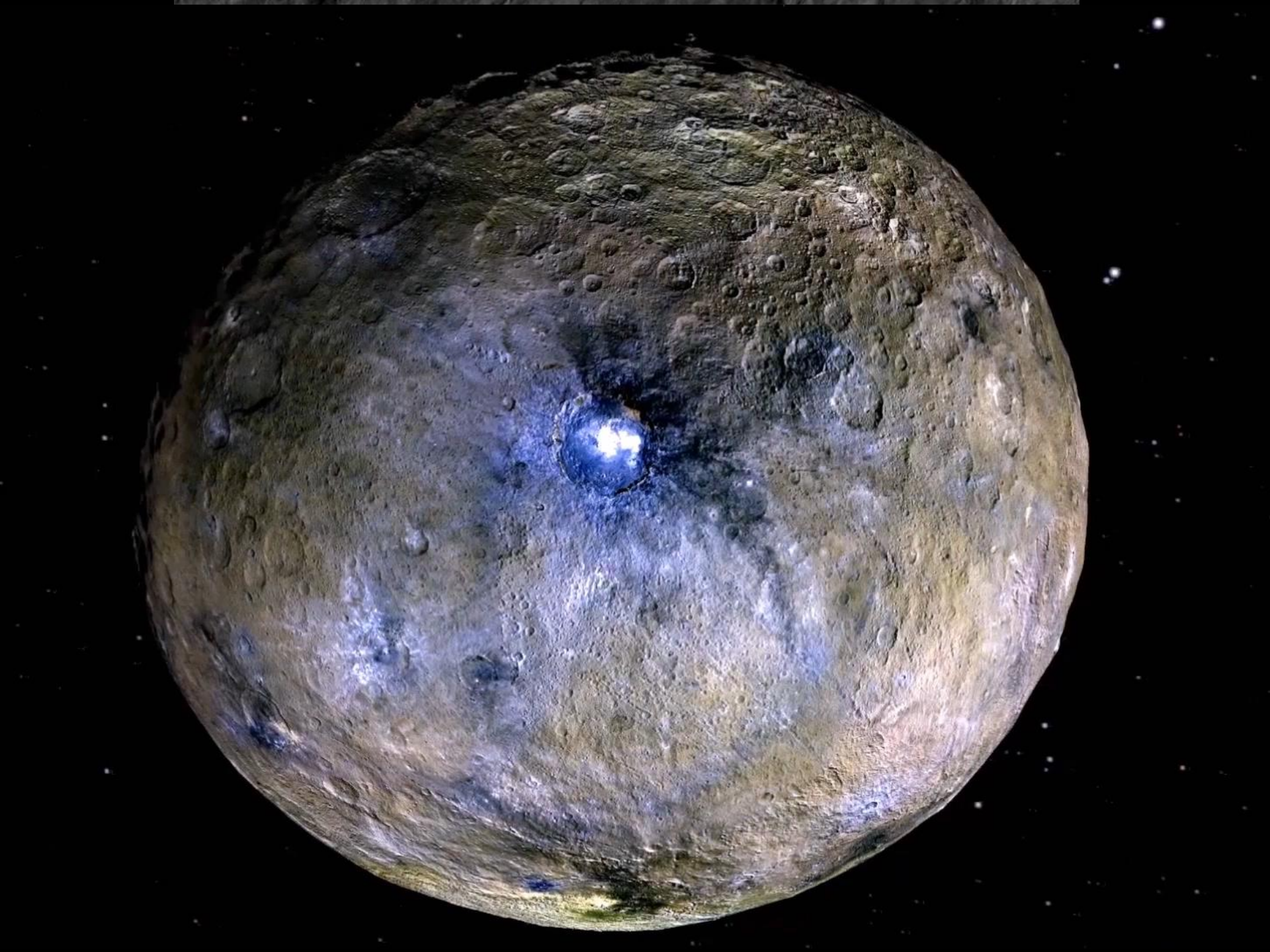
Ceres Mapping Orbits in 2015-2016

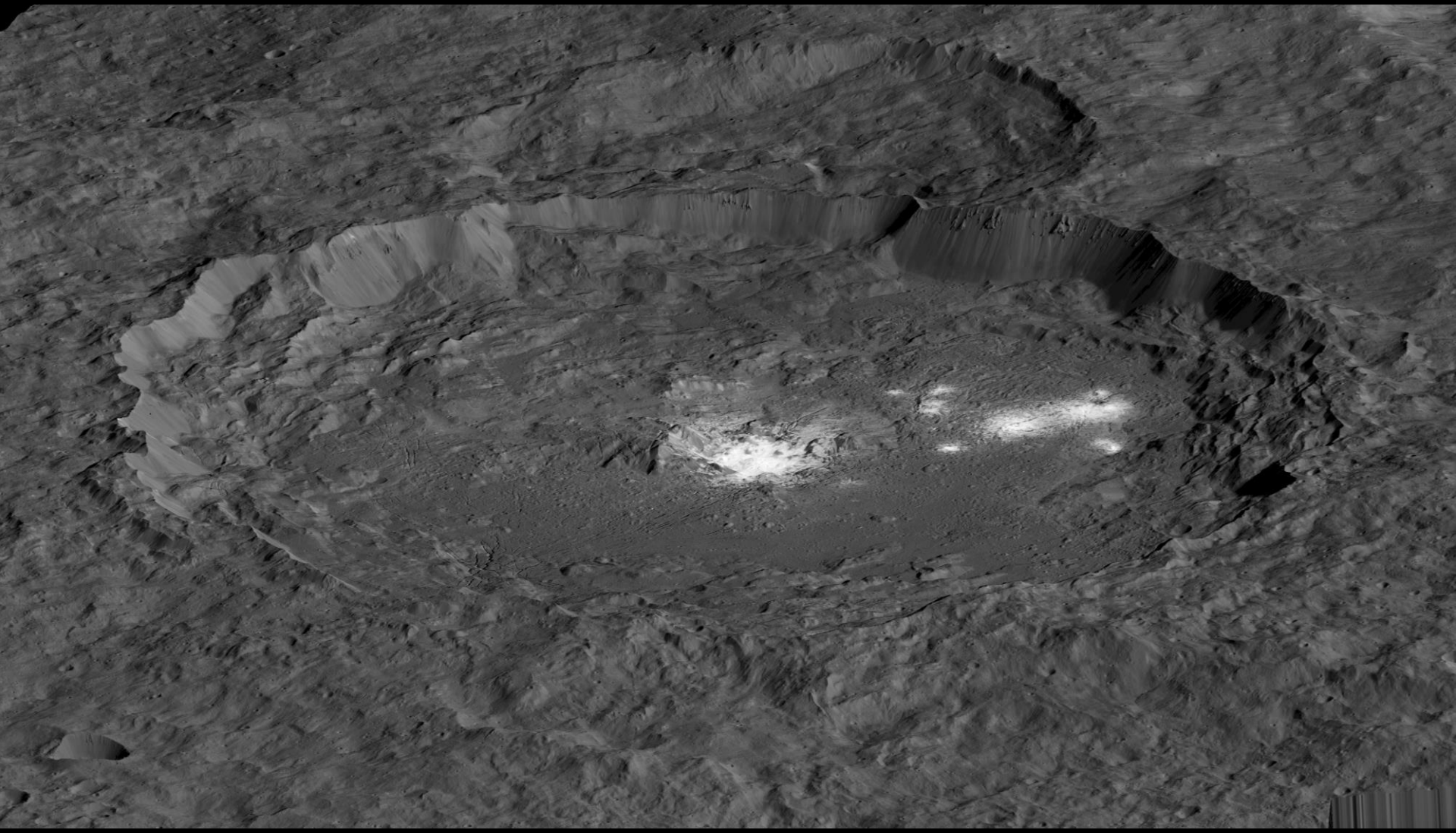


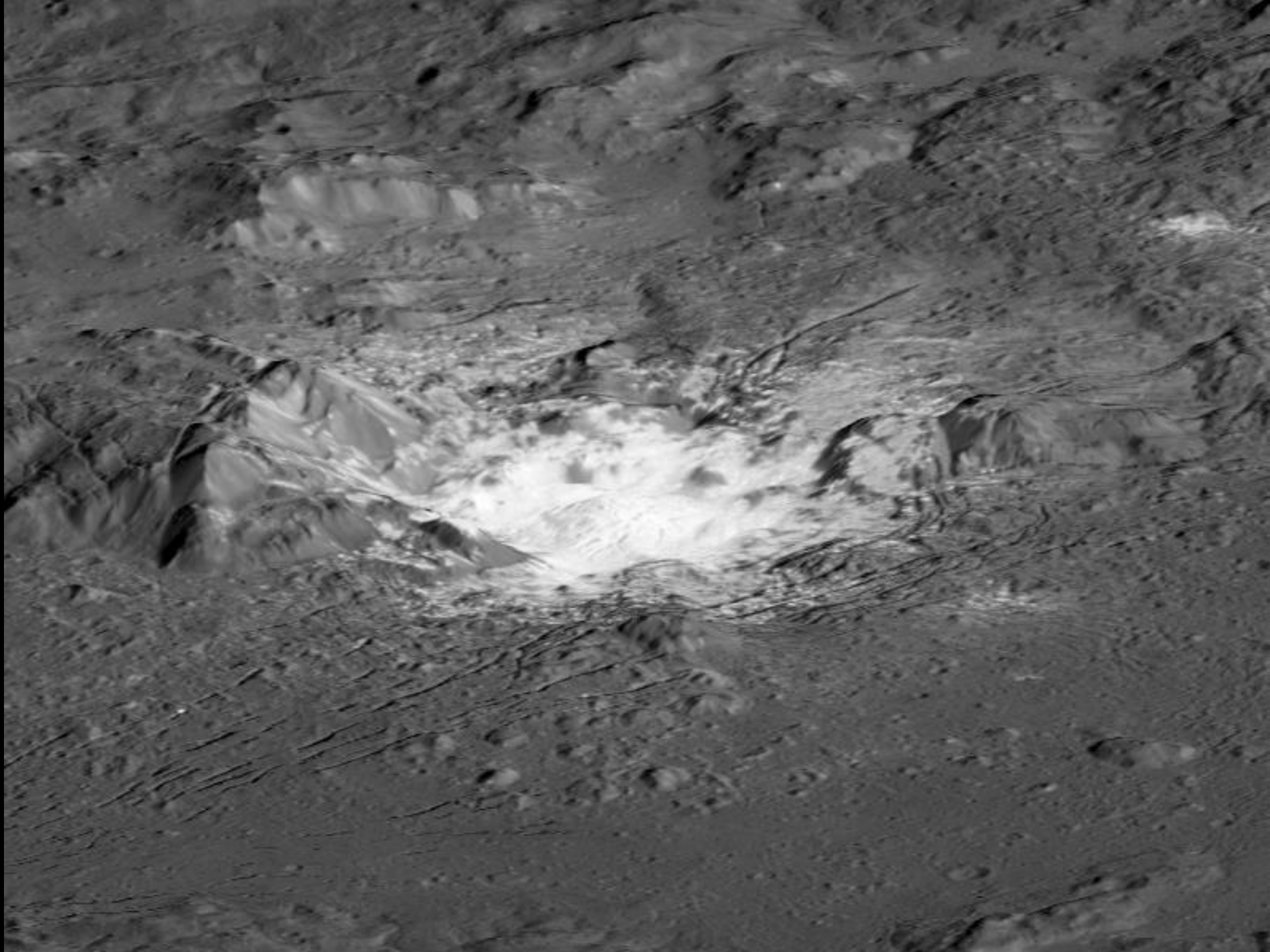

Aug - Oct
1470 km
Dec ‘15 – Sep ‘16
385 km

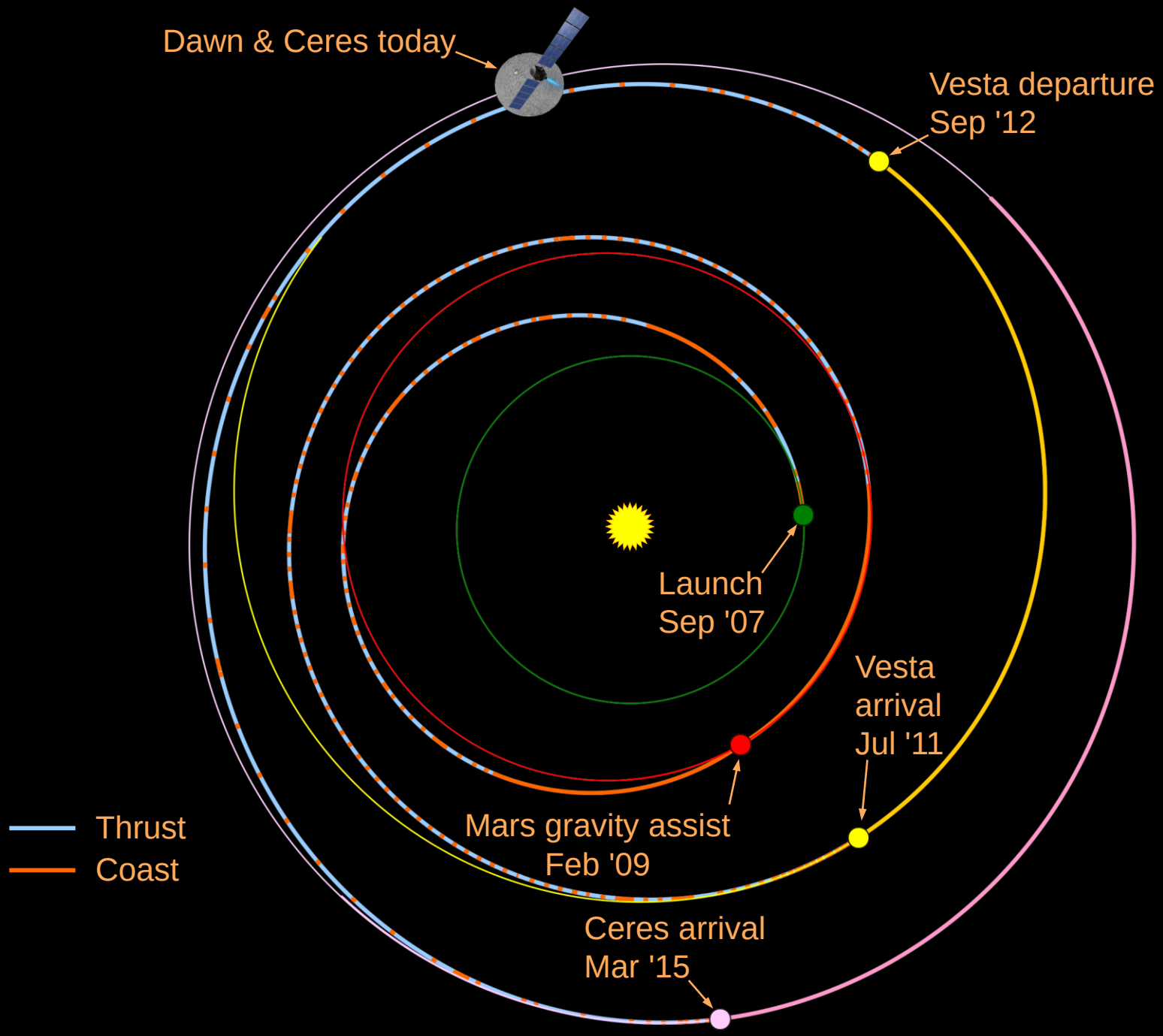
Ceres Mapping Orbits in 2015-2016










Dawn & Ceres today
Vesta departure
Sep '12
Launch
Sep '07
Vesta
arrival
Jul '11
Mars gravity assist
Feb '09
Ceres arrival
Mar '15
Thrust
Coast

Ion Thrusting Achievements

Dawn has achieved the greatest propulsive Δv and the longest powered flight by any spacecraft.

- Δv = 11.3 km/s
- Powered flight time = 5.78 years
  - 59% of time since launch
  - $4.2 \cdot 10^{-8}$ % of time since Big Bang

Conclusions

- Dawn's exploration of the two largest bodies between Mars and Jupiter would have been impossible without electric propulsion..
  - Dawn is the only spacecraft ever to orbit two extraterrestrial destinations.
  - Dawn maneuvered extensively at each body, optimizing its orbits to maximize its scientific productivity.
  - What was viewed as *Crazy Engineering* before Deep Space 1 is now an integral part of solar system exploration.
    - Visit https://www.jpl.nasa.gov/video/details.php?id=1350
- More than 200 years after Ceres was discovered, Dawn has revealed it to be a complex and intriguing world.
  - After fully successful prime and extended missions, NASA is now considering a second extended mission.
- Marc Rayman regrets not being here, but he and I thank you for your attention.
  - He would not let me delete this bullet thanking me for giving his talk.